

1. The method of assembling a loudspeaker, comprising:
  - (a) aligning the frame and the motor structure of the loudspeaker with one another and then connecting them together;
  - (b) forming the moving assembly of the loudspeaker as a unit separate from the frame of the loudspeaker; and
  - (c) connecting the moving assembly to the frame and to the motor structure.
  
2. The method of claim 1 in which step (a) includes:
  - (i) providing a frame having a base formed with a number of spaced mounting bores, a lower flange formed with a number of spaced locator holes and an upper flange formed with a number of spaced surround locator holes;
  - (ii) providing a motor structure having a top plate formed with a number of spaced mounting holes;
  - (iii) aligning the spaced mounting holes in the base of the frame with the spaced mounting holes in the top plate of the motor structure; and
  - (iv) loosely securing a number of screws within the aligning mounting holes of the base of the frame and the top plate of the motor structure.

3. The method of claim 2 in which step (a) further includes:

(i) positioning a centering fixture relative to the frame and the motor structure so that a central sleeve of the centering fixture engages the pole piece of the motor structure, and a number of pins  
5 extending from the centering fixture are received within the locator holes formed in the lower flange of the frame; and

(ii) tightening the screws within the aligning holes in the base of the frame and the top plate of the motor structure.

4. The method of claim 3 in which step (a) further includes the step of removing the centering fixture from the frame and the motor structure.

5. The method of claim 1 in which step (b) further comprises:

(i) providing an assembly fixture having a pole element, a number of spider standoff locator holes and a frame plateau formed with a number of spaced surround locator holes and a number of  
5 spaced surround fixture mounting holes;

(ii) providing a spider standoff having a spider plateau and a number of spaced locator pins; and

(iii) providing a surround fixture having a number of spaced locator pins.

6. The method of claim 5 in which step (b) further comprises:

- (i) affixing an adaptor to the voice coil, the adaptor having at least one glue well; and
- (ii) affixing the lower suspension to the adaptor.

7. The method of claim 6 in which step (b) further comprises positioning the spider standoff relative to the assembly fixture so that the spaced locator pins of the spider standoff engage the spider standoff locator holes in the assembly fixture.

8. The method of claim 7 in which step (b) further comprises:

- (i) positioning the voice coil over the pole element of the assembly fixture so that the lower suspension engages the spider plateau of the spider standoff; and

5       (ii) affixing the lower suspension to the spider plateau.

9. The method of claim 8 in which said step (i) further includes allowing the lower suspension to move along the spider plateau as the voice coil is positioned over the pole element to relieve tolerance stack up and to ensure concentricity of the voice coil relative to the pole element.

10. The method of claim 9 in which step (b) further includes providing an upper suspension connected to a first end of a diaphragm, the upper suspension having an outer flange formed with a number of spaced surround locator pins and a number of spaced mounting holes, the diaphragm having a second end formed with a foot.

11. The method of claim 10 in which step (b) further includes positioning the upper suspension and the diaphragm onto the assembly fixture so that the foot of the diaphragm is received within the at least one glue well of the adaptor affixed to the voice coil, and the spaced surround locator pins on the outer flange of the upper suspension are received within the spaced surround locator holes in the frame plateau of the assembly fixture.

12. The method of claim 11 in which step (b) further includes positioning the surround fixture onto the outer flange of the upper suspension so that the spaced locator pins of the surround fixture are received by the spaced surround clamp mounting holes in the frame plateau thereby securing the upper suspension and diaphragm to the assembly fixture.

13. The method of claim 11 further including the step of allowing the foot of the diaphragm to move within the at least one glue well of the adaptor to relieve tolerance stack up in the moving assembly, and then affixing the foot of the diaphragm to the at least one glue  
5 well.

14. The method of claim 13 in which step (b) further includes removing the moving assembly from the assembly fixture.

15. The method of claim 14 in which step (c) further comprises:

(i) positioning the voice coil over the pole piece of the motor structure;

(ii) inserting the spider standoff locator pins of the spider  
5 standoff through the locator holes in the lower flange of the frame; and

(iii) inserting the surround locator pins of the upper suspension within the locator holes in the upper flange of the frame.

16. The method of claim 15 in which step (c) further comprises:

(i) positioning a surround clamp onto the outer flange of the upper suspension so that threaded holes formed in the surround clamp align with the mounting holes in the outer flange of the upper

5 suspension and with mounting holes in the upper flange of the speaker frame;

(ii) inserting screws into the aligning mounting holes of the upper flange of the speaker frame, the mounting holes of the outer flange and the threaded holes of the surround clamp to secure the  
10 surround clamp to the upper suspension and to the speaker frame.

17. The method of claim 15 in which step (c) further includes threading nuts onto the end of the spider standoff locator pins extending through the locator holes in the lower flange of the speaker frame to secure the spider standoff to the speaker frame.

18. A loudspeaker, comprising:

a frame having a base, a lower flange formed with a number of spaced locator holes and an upper flange formed with a number of spaced locator holes;

5 a motor structure having a top plate and a pole piece, said base of said frame being mounted to said top plate of said motor structure so that said upper and lower flanges of said frame are substantially concentric to said pole piece;

an assembled moving structure, including:

- 10 (i) a voice coil;
- (ii) a spider standoff substantially concentrically disposed about said voice coil, said spider standoff having a number of locator pins;
- (iii) a lower suspension extending between and  
15 coupled to said voice coil and said spider standoff;
- (iv) an upper suspension having an outer flange formed with a number of locator pins; and
- (v) a diaphragm extending between and coupled to said upper suspension and said voice coil;

20 said assembled moving structure being positioned on and mounted to said frame and said motor structure by aligning and inserting said locator pins of said spider standoff within said locator holes in said lower flange of said frame, and by aligning and

inserting said locator pins of said outer flange of said upper  
25 suspension within said locator holes in said upper flange of said  
frame.

19. The loudspeaker of claim 18 further including an adaptor  
mounted to said voice coil, said adaptor being formed with at least  
one glue well.

20. The loudspeaker of claim 19 in which said spider standoff is  
formed with a plateau, said lower suspension being mounted to said  
adaptor of said voice coil and to said plateau of said spider standoff.

21. The loudspeaker of claim 20 in which said plateau of said  
spider standoff is dimensioned to permit radial movement of said  
lower suspension relative to said plateau prior to being affixed to  
said spider standoff to ensure substantial concentricity between said  
5 voice coil and said pole piece.

22. The loudspeaker of claim 19 in which said diaphragm is formed  
with a foot which is mounted within said at least one glue well of  
said adaptor, said at least one glue well being dimensioned to allow  
said foot to move therein prior to being affixed to said at least one  
5 glue well.



23. The loudspeaker of claim 18 further including a surround clamp mounted to said outer flange of said upper suspension and to said upper flange of said frame to secure said upper suspension to said frame.

24. The method of assembling a loudspeaker, comprising:

(a) aligning the frame and motor structure of the loudspeaker relative to one another using a centering fixture, and then securing the frame to the motor structure so that an upper  
5 flange and a lower flange of the frame are substantially concentric to the pole piece of the motor structure;

(b) providing an assembly fixture to fabricate the moving assembly of the loudspeaker separate from the frame and motor structure, the moving assembly including a voice coil, an upper  
10 suspension, a lower suspension, and a diaphragm connected at one end to the upper suspension, the assembly fixture having a pole element, a base formed with a number of spider standoff locator holes and a frame plateau;

(c) providing a spider standoff having a number of locator  
15 pins and a spider plateau;

(d) locating the voice coil on the pole element of the fixture, inserting the locator pins extending from the spider standoff into the spider standoff locator holes of the fixture and coupling the lower suspension to the plateau of the spider standoff;

20 (e) inserting pins extending from the upper suspension into locator holes formed in the plateau of the assembly fixture, and coupling one end of the diaphragm to the voice coil;

(f) removing the moving assembly from the assembly fixture;

25 (g) inserting the pins extending from the spider standoff through locating bores formed in the lower flange of the frame;

(h) inserting the pins extending from the upper suspension into locator holes formed in the upper flange of the frame; and

(i) affixing a surround clamp onto the upper suspension  
30 and to the upper flange of the frame.

25. The method of claim 24 in which step (a) further includes initially loosely securing the frame to the motor structure with screws, locating the centering fixture relative to the frame and motor structure and then tightening the screws.

26. The method of claim 24 in which step (c) further comprises:

(i) affixing an adaptor to the voice coil, the adaptor having at least one glue well; and

(ii) affixing the lower suspension to said adaptor.

27. The method of claim 26 in which step (d) further includes allowing the lower suspension to move along the spider plateau as the voice coil is positioned over the pole element of the assembly fixture to ensure concentricity of the voice coil relative to the pole

5 element and to remove tolerance stack up, and then coupling the lower suspension to the spider plateau.

28. The method of claim 26 in which step (d) further includes allowing a foot formed at one end of the diaphragm to move within the at least one glue well of the adaptor mounted to the voice coil to relieve tolerance stack up, and then affixing the foot of the  
5 diaphragm to the at least one glue well.

29. The method of claim 24 further including the step of securing a nut onto a threaded end of each of the locator pins of the spider standoff which extend through the locating bores formed in the lower flange of the frame.

30. The method of claim 24 in which step (i) further includes securing screws within the upper flange, the outer flange of the upper suspension and the surround clamp.

31. An assembly for connection to the motor structure and frame of a loudspeaker, comprising:

a voice coil;

a spider standoff substantially concentrically disposed about  
5 said voice coil, said spider standoff having a number of locator pins which are adapted to be received within locator holes formed in the motor structure of the loudspeaker;

a lower suspension extending between and coupled to said voice coil and said spider standoff;

10 an upper suspension having an outer flange formed with a number of locator pins which are adapted to be received within locator holes formed in the frame of the loudspeaker; and

a diaphragm extending between and coupled to said upper suspension and said voice coil.

32. The assembly of claim 31 in which said spider standoff is formed with a plateau which mounts said lower suspension, said plateau being dimensioned to receive and permit movement of said lower suspension relative to said plateau prior to being affixed  
5 thereto.

33. The assembly of claim 31 in which said voice coil mounts an adaptor formed with at least one glue well.

34. The assembly of claim 33 in which said diaphragm is formed with a foot which is mounted within said at least one glue well of said adaptor, said at least one glue well being dimensioned to allow said foot to move therein prior to being affixed to said at least one
- 5 glue well.

35. The method of fabricating the moving assembly of a loudspeaker, comprising:

- 5 (a) providing an assembly fixture having a pole element, a base formed with a number of spider standoff locator holes and a frame plateau;
- (b) providing a spider standoff having a number of locator pins and a spider plateau;
- (c) locating the spider standoff on the base of the assembly fixture by inserting the locator pins of the spider standoff into the  
10 spider standoff locator holes;
- (d) locating a voice coil coupled to a lower suspension over the pole element of the assembly fixture;
- (e) affixing the lower suspension to the spider plateau of the spider standoff;
- 15 (f) affixing a diaphragm coupled to an upper suspension to the voice coil.

36. The method of claim 35 in which step (e) further includes allowing the lower suspension to move along the spider plateau of the spider standoff prior to affixing the lower suspension thereto.

37. The method of claim 35 in which step (b) further includes mounting an adaptor to the voice coil, the adaptor being formed with at least one glue well.

38. The method of claim 37 in which step (f) further includes forming the diaphragm with a foot, the foot of the diaphragm being received and mounted within the at least one glue well of the adaptor.

39. The method of claim 38 in which step (f) further includes allowing the foot of the diaphragm to move within the at least one glue well prior to affixing the foot therein.